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Music and Its Application in the Classroom

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Bowling Green State University

The purpose of this action research project is to determine if background music can be used to improve student test scores using the Mozart Effect. The participants were twenty-eight juniors and seniors from two Algebra II classes at Sylvania Southview High School. Each student in the study was given a control quiz, taken with no background music, followed by the experimental quiz, taken with classical music, specifically Mozart's "Sonata for Two Pianos in D, K. 448", playing in the background. The mean average of the students' first quiz was 2.7% higher than the mean average of the second quiz taken while classical music was played. Statements were collected through a post-quiz survey, where several students said the classical music helped them relax and concentrate, but a similar number of students said it did the opposite, distracting them and making it harder for them to take the quiz. There was no evidence of the Mozart Effect taking place for the entirety of the class. However, there were several factors which may have changed the results, including students having a break between the quizzes, the volume of the music, and motivational fatigue.

Introduction

There has been a continuous debate in the education community on the best ways to improve students' test scores and their comprehension levels. Various ideas, including classroom sizes, types of textbooks, and amounts of homework, have been discussed for years. One less known method of potentially helping students succeed is the implementation of music into the classroom. This led me to my question, "What effect can background music have on students' scores when played during tests and/or quizzes?" Classical music - specifically Mozart's pieces, has shown improvement in students' performances and increases of eight to nine IQ points for short durations, approximately ten to fifteen minutes (Kya, Rauscher, & Shaw, 1994; Jenkins, 2001). This is known as the "Mozart Effect". Some studies, such as Kelly and Manthei's (1999), refute the "Mozart Effect" and say background music has no effects on test scores. Perhaps the results of my study, whether positive, neutral, or negative, may become an influence over a student's study habits and thus changing his or her academic performance in the future.

I use several terms throughout this paper which should be defined. Background music is defined by Kelly and Manthei (1999) as "any music played while the listener's attention is focused primarily on a task or activity other than listening to the music." Mood calming or relaxing music was determined in the Hallam and Price (1998) and Hallam, Katsarou, and Price (2002) studies as music which was "calming" to most of the participants, including Walt Disney tracks and other children's pieces. Classical music is also categorized under mood calming or relaxing. Aggressive music is determined by Hallam, Katsarou, and Price (2002) as music which is unpleasant or arousing, which includes John Coltrane's "The Father, the Son, and the Holy Ghost", and the genres rap, pop, and rock.

Literature Review

The reason for this action research project is to discover if the implementation of music into a mathematics course can impact the students' scores. There are various factors which may affect a student's scores, such as social interactions, mood the day of assessment, economic status, and access to materials and tools, for example. However, could music be a way to provide support to all students despite their backgrounds? It is important to know the results of previous research on music being used in mathematics classes in order to determine what methods to use for further research.

History of Music in Schools

Music is a worldwide aspect of life and can be seen as impactful throughout all cultures and history (Gold, Frank, Bogert, & Brattico, 2013). The genre of music changes between cultures, but while some forms may be looked down upon by certain groups, such as rap and screamo sometimes being labeled as negative influences, music in general has developed to become a vital part of life for most. As groups move and colonized are formed, music is sure to follow, just as how it made its way to the United States with the Pilgrims in the seventeenth century (Music Education). Informal teaching of music in American schools began during this same century, as it was necessary for singing in churches (Music Education). Music began to gain a foothold in education when the first school dedicated to teaching singing was founded in 1717 in Boston (Stanford, 2012; Music). By the 1800s music education courses could be found in elementary schools around the nation (Music Education). Students today have a variety of music education courses they can take during high school, including band, chorus, and show choir, but some opt out in pursuit of other electives.

Positive Effects

Although music education courses are not required for every student to graduate, should students still be experiencing music in their classes to not necessarily teach them about the production of music or how to play an instrument, but to potentially enhance their learning of other subjects, such as mathematics? Previous research shows various positive effects of listening to music, both in and outside the classroom. These include decreased behavioral issues in the classroom (Hallam & Price, 1998; Hallam, Katsarou, & Price, 2002) and increase in mathematical performance while listening to certain types of music (Hallam & Price, 1998; Hallam et al., 2002; Jenkins, 2001; Maas, 2013).

Behavioral Improvements

Classroom management may be a challenging skill for teachers to learn, and depending what students are in the class, may be a crucial skill to have. Some students have learning disabilities, such as Attention Deficit Disorder (ADD) and Attention Deficit Hyperactivity Disorder (ADHD). Other students may have emotional and behavioral difficulties which make them act out in aggressive and disruptive ways, including tantrums, violence, crying, and verbal confrontations (Hallam & Price, 1998).

One study conducted by Hallam and Price (1998) focused on the effects of playing background music during classroom sessions. The study followed ten students (two girls and eight boys), all between the ages of nine and ten, who attended a school for students with emotional and behavioral issues. The students were routinely reminded of various rules to follow in the classroom. It was considered rule breaking if students completed any of the following:

- addressing a teacher without first raising a hand and waiting to be spoken to;
- comments to other children;

- leaving seats without first gaining permission;
- hitting or making threatening gestures;
- making excessive noise non-verbally (e.g. banging an object) (p. 89)

Before each session, the students were told to quietly solve as many math problems as they could during a certain amount of time. The students did such at times with and without background music. The results of the study indicate the students initiating rule breaking behaviors during session when the background music was played. Students were also less aggressive and more cooperative. The study shows a negative association between the number of times rules were broken and the amount of correctly completed math problems, which suggests the improved academic performances were related to the students' improved behaviors.

Mathematical Performance

Hallace and Price's study (1998) also concluded that four of the seven sessions showed "a significant positive effect on mathematics performance when background music was used," and "even where the differences were non-significant, the effects of the music were always positive." Students with the best mathematical performance improvements were those with "hyperactive" syndrome, or ADHD. These students require stimuli to function and it was thought the music helped to satisfy this need. Students with ADHD continued to break the rules established by the teacher but did their work while talking instead of giving up the work entirely to be disruptive. The results portray the idea that students who require a stimulus may perform better in the classroom if there is background music being played.

Other studies have moved away from focusing on the behaviors of students and directed their work at the performance levels of students with various genres of music playing in the background. The genre of music which has presented the most improvement for academic

performances is classical, specifically pieces composed by Mozart (Kya et al., 1994; Jenkins, 2001; Maas, 2013). Maas (2013), who completed a study involving high school mathematical students in an Algebra II class, writes “Classical music has a positive relationship with math scores.” Kya, Rauscher, and Shaw (1994) and Jenkins (2001) write about the “Mozart Effect”, which is a short-term increase in spatial task performance caused by listening to Mozart’s compositions. Kya, Rauscher, and Shaw’s study (1994) involves thirty-six undergraduate students who were tested on such tasks as identifying the correct image after different folds and cuts were performed on a piece of paper. The students who listened to Mozart in comparison to no music and audible relaxation instructions showed significantly higher scores and an increased spatial IQ of eight to nine points. Jenkins (2001) wrote on this study and states Rauscher said “the Mozart effect is limited to spatial temporal reasoning and that there is no enhancement of general intelligence.”

Although the Mozart Effect doesn’t appear to be able to improve someone’s general intelligence, it does improve an important factor of mathematics, which is visual-spatial processing skills. Kelly defines visual-spatial processing as “the ability to tell where objects are in space,” and says it “involves being able tell how far objects are from you and from each other.” The rotation of objects in trigonometry and calculus require these skills, as does a child’s need to align numbers vertically for addition and subtraction (Kelly, K.). Mathematics is a subject which needs a lot of imagination, such as visualizing the rotation of a curve about an axis in three-dimensional space and then using formulas to determine said figure’s volume. These studies suggest listening to Mozart during this process may enhance the listener’s ability to accomplish the task with accuracy.

Neutral and/or Negative Effects

Although some research studies have found positive effective for background music during mathematics classes, there certainly have been studies which found the music to cause minimal results or even negative effects. The genre of music being played is indeed a factor for the overall results, as aggressive music like pop, rock, and rap don't show nearly the same academic and behavioral benefits as classical (Hallam et al., 2002; Maas, 2013). Kelly and Manthei (1999) and Goldsmith (2017) even go on to say that classical music showed no significant results for improving students' scores. Several researchers have determined certain types of music as more distracting than beneficial (Goldsmith, 2017; Hallam et al., 2002), while others have concluded certain types of background music to yield similar or worse scores in comparison to no music (Kelly & Manthei, 1999; Maas; 2013).

Distracting

Teachers attempt to keep their students focused on their work, either by establishing authority and respect in the classroom or through other means. Teachers also want to keep their classes entertaining, which is often done by creative projects, videos, or playing music. However, it's been suggested that playing music during assignments can be quite distracting for students (Goldsmith, 2017; Hallam et al., 2002). Goldsmith (2017) states, "Classical music played during exams can be seen as being as much a distraction as it could be a benefit to students who need to relax." She reaches this conclusion by reasoning that "classical music was never meant to be listened to passively and within a multitasking context." Hallam, Katsarou, and Price (2002) veer away from suggesting classical music as distracting but instead suggesting aggressive music can disrupt a student's efforts. In their study students were seen to become distracted by the background music, losing focus on the task at hand. Listening to the music resulted in the

disruption of their work and the disturbance of others. The students would eventually return to their work, but not only had this disruption affected the distracted student but it also affected the surrounding students. These two studies suggest music may be having the opposite effects on students than what teachers are hoping.

Similar Scores and/or Negative Effects

Another effect of certain types of background music being played during assignments is that the students' scores are overall very similar or even worse than those without music (Hallam et al., 2002; Kelly & Manthei, 1999; Maas; 2013). Maas' (2013) study involved testing four algebra II classes over four different types of music, which were classical, rap, rock, and no music. She makes the claim that rap and rock music minimally affected the students' scores in comparison to the quizzes taken with no background music (page 15). Students ages ten to twelve showed worsened performances on memory tasks when subjected to aggressive music in comparison to no background music (Hallam et al., 2002). Another study which supports the claim that background music has insignificant effects on students was conducted by Kelly and Manthei (1999) and involved seventy-two undergraduate students. These students took mathematics placement tests under the conditions of no music, classical music, and popular music, which was ZZ Top's "Somebody Else Been Shakin' Your Tree". None of conditions produced significant difference in scores from the others, allowing the conclusion that background music provides neither positive nor negative effects on math test performances. These various studies determined background music, in some cases all types and others just those pieces which are aggressive, as ineffective in increasing students' math scores or actually worsened their scores in comparison to tests with no background music.

Conclusions

There have been both positive and negative results from studies which look at the effects of different types of background music playing during class session. None of the studies said rap, pop, rock, or any other genre of music other than classical would cause any significant change in test scores in comparison to score with no background music. Mood calming music has been shown to mitigate behavioral difficulties for students, while aggressive music was shown to worsen academic performance and increase outburst tendencies. This could be because music may have acted as a stimulus for those students who seek stimuli, such as students with ADHD.

Methodology

Participants

The participants consisted of twenty-eight students in the same mathematics course, which is a double block Algebra II for high school juniors and seniors. Twelve of the participants are from one class while the other sixteen are in another double block Algebra II class. There was one male junior in each of the classes, with the remainder of each class being seniors. Sixteen of the twenty-eight students were females, six coming from the first class and ten from the second class. The remaining twelve males were split between the two classes with six coming from each class.

The students were from a suburban district in northwestern Ohio. Each of them had shown struggles in mathematics before this school year, so they were placed in a double block course to receive extra time and assistance with the mathematics content.

Procedure

I focused my study to comparing the effects of classical music and no music during a quiz. I avoided using rap and pop music as previous research showed both to yield minimal changes in test scores. The hope was to see replication of the “Mozart Effect” through this study. I also let the students know in advance of the study, telling them I will be playing classical music during a quiz. They were told they could opt out of taking the quiz if they wanted but were first informed I would be keeping the better of their quiz scores, essentially giving them two chances to take a quiz on the topic.

I gathered some data on the students’ backgrounds with music by giving the two classes a pre-quiz survey, Appendix A. The students were then given two versions of a quiz consisting of six questions about simplifying radicals. The questions on the quizzes were of the same difficulty, with each numbered question from version one of the quizzes corresponding to the

same numbered question on version two. For instance, question one on each quiz required the students to simplify a radical with an index of three. Each required the same number of steps, supporting their difficulty being approximately the same. Corresponding questions consisted of the same point value and were graded in the same manner between both quizzes. Finally, those students who had completed the pre-quiz survey and both versions of the quiz were given a post-quiz survey.

The double block course involves forty-two minutes of instruction, a four-minute break, and then forty-two minutes of instruction again. During the first part of the double block course, the students were given version one of the quiz, Appendix B, without music playing. After the four-minute break was completed, the students were then given version two of the quiz, Appendix C, with classical music playing. I used Mozart's "Sonata for Two Pianos in D, K. 448". This piece was approximately six minutes in length, so I played it on a loop for the entirety of the second section of instruction.

After the quizzes were graded, I asked certain students, those who took both versions of the quiz and filled out the pre-quiz survey, to complete a post-quiz survey, Appendix D. I informed each student which quiz they did better on and had them fill out questions based upon this information.

Results

I gathered the data collected from each part of the action research process, finding I had twenty-eight completed sets of information from the two classes to analyze. I went through the pre-quiz surveys, looking for trends amongst the students. I compared the data received from the two versions of the quiz. I also looked at the post-quiz survey, attempting to see if there were any trends as well or any surprising answers to questions.

Pre-Quiz Survey

The charts below represent student responses on the pre-quiz survey. The students were asked to use a scale from 1-5, where 1 is “never”, 2 is “rarely”, 3 is “sometimes”, 4 is “a great deal”, and 5 is “always”, to answer a few questions. Chart 1A shows the students’ responses to the question, “How often do you listen to music while doing homework?” and Chart 1B depicts the answers to “How often do you listen to music while studying?”

Chart A

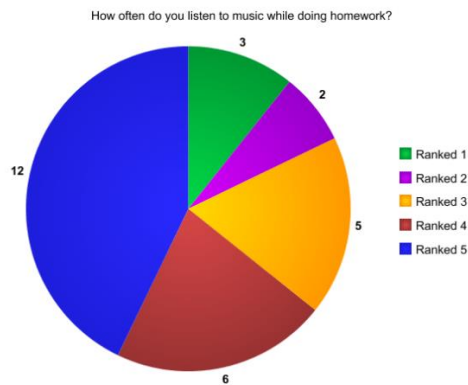


Chart B

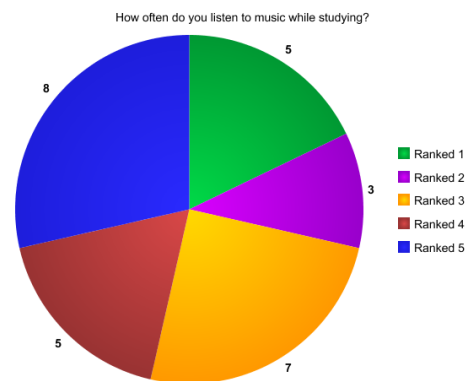


Chart A shows twenty-three out of twenty-eight students ranked the question as 3 or higher, meaning approximately 82.1% of the students are “sometimes” or more often listening to music while doing homework. The figures are similar when looking at Chart B, which shows twenty out of twenty-eight students ranking the question as 3 or higher, meaning approximately 71.4% of the students are “sometimes” or more often listening to music while studying.

Chart C below follows the same scaling system as Chart A and B above, while Chart D shows the results of question 6 from the pre-quiz survey. The students were provided with a list of different genres of music and were asked “What is your favorite genre of music?”

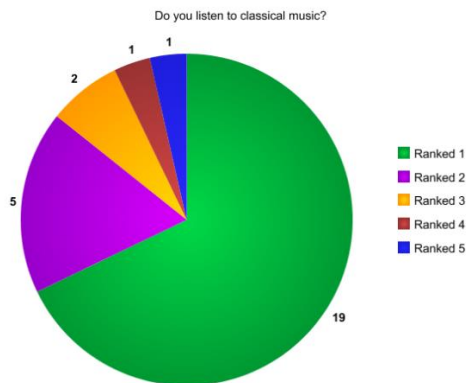
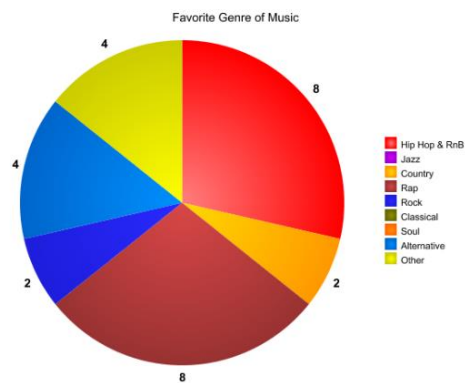
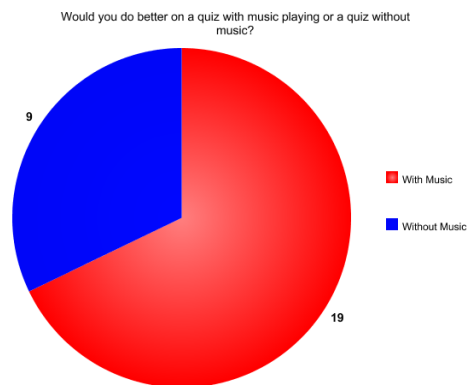
Chart C**Chart D**

Chart C shows nineteen of twenty-eight, or 67.9%, students surveyed claim to never listen to classical music. Chart D shows zero students claim classical music as their favorite genre of music.

Chart E shows the results of question nine from the pre-quiz survey, which asks, “Do you believe you would do better on a quiz with music playing or a quiz without music playing?”

Chart E

Based upon Chart E, nineteen of twenty-eight, or 67.9%, students surveyed claim they would do better on a quiz while music plays versus nine of twenty-eight, or 32.1%, students believing they would do worse with music playing. Some student responses as to why they believed they would do better include:

- “*I would be more relaxed.*”

- *“Music helps me concentrate and relax.”*
- *“I listen to it when I study. It conditions you.”*

Some of the responses for why some students believed they would do worse on a quiz with music include:

- *“I have ADD so it’s harder for me to focus. I need a quiet space.”*
- *“I can’t focus when I’m listening to a song.”*
- *“It helps me focus and think when it’s quiet.”*

Quiz Results

The quiz results showed six of twelve, or 50%, students in the first class and nine of sixteen, or 56.25%, students in the second class, totaling fifteen of twenty-eight, or 53.6%, improved with classical music playing in the background. However, the mean average for each class decreased from the quizzes without music to those taken with classical music playing. The students from the first class averaged 10.63 out of 17 points, or 62.5%, on the quiz without music and 10.29 out of 17 points, or 60.5%, on the quiz while classical music played. The students from the second class averaged 12.13 out of 17 points, or 71.4%, on the quiz without music and 11.53 out of 17 points, or 67.8%, on the quiz while classical music played. Overall, the students averaged, 11.38 out of 17 points, or 66.9%, on the quiz without music and 10.91 out of 17 points, or 64.2%, on the quiz while classical music played. The students completed the quiz without music with an increased accuracy of 2.7% in comparison to the quiz taken with classical music playing.

Post-Quiz Survey

The charts below, Chart F and Chart G, represent how many students would or would not like to listen to music during future quizzes and what genres of music are preferred by those who would want music during future quizzes.

Chart F

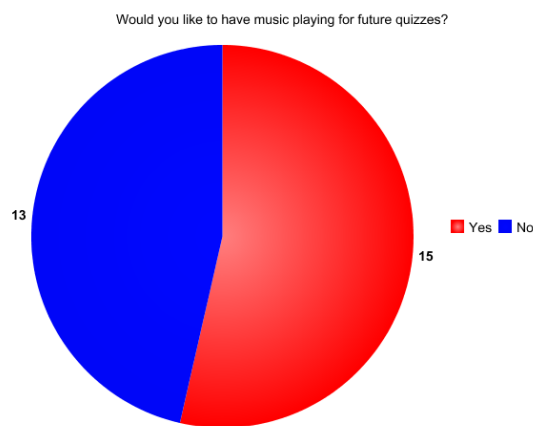
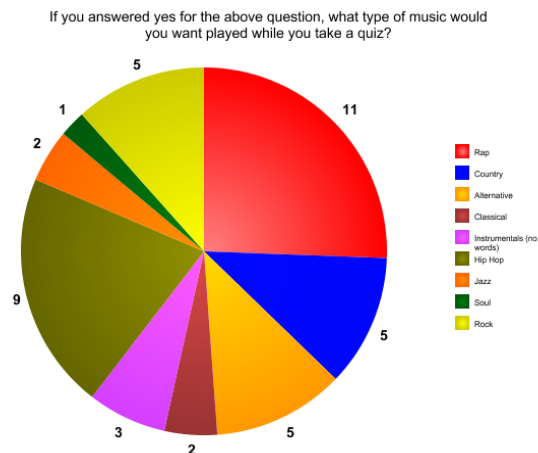


Chart G



The same percentage of students who did better on the quiz with classical music playing, or 53.6%, stated they want music to play on future quizzes. Chart G shows these students would prefer Rap (receiving eleven responses) or Hip Hop (receiving nine responses) on future quizzes, with classical receiving two responses.

The students were asked if their expectations made on question nine of the pre-quiz survey were correct. Some of the student responses from those who did better on the quiz with classical music playing include:

- “No, I did better with music.”
- “Yes, because I was not as stressed as I always am. The music was calming.”
- “No, I didn’t expect to do better with music.”

Some of the student responses from those who did better on the quiz without music include:

- *“Yes. I expected to do better without music because I like it quiet during a test or quiz.”*
- *“No. I think it is because it wasn’t music I personally listen to.”*
- *“Yes. I can really only concentrate on one thing at a time, so the music didn’t help.”*

Discussion

Not every student in the two double block Algebra II classes participated in my action research study. Almost every student had completed the pre-quiz survey, but then some students did not complete later parts of the study. There were multiple students who objected to taking the second quiz, which would have the music. Other students were absent the day of the research, so they missed taking both quizzes. They were later given the first quiz without music and not the quiz with music. I have only reviewed the data from those students who completed all parts of the study, which includes the pre-quiz survey, both the quiz without music and the one without music, and the post-quiz survey. Perhaps students who did not take both versions of the quiz may have benefited from the classical music playing.

The quiz scores seem promising, showing 53.6% of the students analyzed doing better with classical music playing. However, the mean average decreased for each class. There were two students in the second class who did poorly on the first quiz and seemed to lose motivation for the second version. One of these students struggled on the first quiz, receiving a 4 out of 17, or 23.5%, and then gave up trying during the second quiz. He turned it in blank and thus received a 0 out of 17, or 0%. The second student showed similar behavior, first receiving a 6 out of 17, or 35.3%, and then a 1 out of 17, or 5.9%. These two quizzes skewed the data for the second class. Excluding these two students’ quiz scores, both with and without music, changes the means of the class to 13.14 out of 17, or 77.3%, without music playing and 13.11 out of 17, or 77.2%, and

the overall means to 11.89 out of 17, or 69.9%, for the quiz taken without music playing and 11.7 out of 17, or 68.8%, for the quiz taken while classical music played. The difference in accuracy would then be 1.1% in favor of the quiz taken without music rather than the difference of 2.7% increased accuracy for the first quiz.

Maas (2013) suggested “Classical music has a positive relationship with math scores.” However, my action research seems to claim otherwise. The quiz scores were similar between those taken without music and those taken with music, especially when quizzes which skewed data are excluded. There were mixed reviews from the students about whether the music was a distraction or helped them relax and concentrate. Some of the students claims include, “*the music relaxed me and helped me focus during the test,*” and “*the music was calming,*” while others stated, “*I was more focused with no music*” and “*I can really only concentrate on one thing at a time, so the music didn’t help.*” Goldsmith (2017) states, “Classical music played during exams can be seen as being as much a distraction as it could be a benefit to students who need to relax.” The class was divided on the benefits of the music being played, as it helped some focus but distracted others.

There are a few factors which could have changed the results of the students’ quizzes. First, the students took both versions of the quiz on the same day, the second beginning approximately five minutes after the last student finished the first one. The students could have looked over material during the break between classes. The music kept changing volumes throughout the quiz, so I had to continually adjust the volume to keep it from being too overpowering to the students. The change in volume may have had an effect on the students, especially by distracting them from the quiz. Motivational fatigue was also a factor. Two students decided during the first quiz they didn’t know the material and gave up before

attempting the second version, thus receiving a 0 out of 17 and a 1 out of 17. Perhaps other students felt the same loss in motivation, so their second quiz scores may not accurately reflect their knowledge on the subject, or the effect of the music being played. Perhaps the order of the quizzes matters as well. I administered the first quiz without music and then the second with classical music playing. The students may have improved their scores based on

I heard from multiple students they wanted to listen to their own music. One student in the first class asked me to change the classical music to rap while he was taking the quiz. Based on the post-quiz results represented by Chart F and Chart G I believe a way to continue this action research project is allowing my future students to choose their own type of music to take during a quiz. Students could be given the option to take a quiz with or without music. If they choose to take it with music, I would let them use a cell phone and headphones to listen to various types of music.

In conclusion, my research does not confirm the Mozart Effect taking place with my students. Several students said the classical music helped them relax and concentrate, but a similar number of students said it did the opposite, distracting them and making it harder for them to take the quiz. The mean average of the participants decreased from the first version of the quiz to the second, even so with two very low scores being exempted.

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- Hallam, S., Katsarou, G., & Price, J. (2002). The effects of background music on primary school pupils' task performance. *Educational Studies*, 28(2), 111-122. DOI: 10.1080/03055690220124551
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 - This study looks at the effects of playing background music in a classroom of a school for children who have behavioral and emotional difficulties. Ten students were observed and it was noted the students had improvements in their behavior and mathematical performances when the music was played. The students were less aggressive, as well as more co-operative, in lessons following the study.
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- Kelly, K. *Visual-spatial processing: What you need to know*. Retrieved from <https://www.understood.org/en/learning-attention-issues/child-learning-disabilities/visual-processing-issues/visual-spatial-processing-what-you-need-to-know>
 - Math deals with visual spatial task skills. Trigonometry/Calculus require imagining the rotation of objects in space. Understanding symmetry and simple arithmetic also involves these skills as both require the ability to see the placement of shapes or numbers to make conclusions about the results.

- Kelly, S. N., & Manthei, M. (1999, May 1). Effects of popular and classical background music on the math test scores of undergraduate students. *Research Perspectives in Music Education*, 6(1), 38-42(5). Retrieved from <http://music.arts.usf.edu/rpme/effects.htm>
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- This is an article written by a college student who conducted research based on different types of music and their effects on students who hear them during math tests. She determined classical music was the most beneficial to the students, while rap and rock music did little to help.
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 - This article talks about the history of music education in the U.S. It goes into detail about the first singing school and discusses the current conditions of music education throughout the nation.

Appendix A

Name: _____

Date: _____

Research Pre-Quiz Survey

Answer the following questions on a 1-5 scale.**Scale: 1 - Never, 2 - Rarely, 3 - Sometimes, 4 - A Great Deal, 5 - Always**

1. How often do you listen to music while doing homework? _____
2. Do you listen to classical music? _____
3. Does music ever help you relax? _____
4. How often do you listen to music while studying? _____
5. Do you listen to more aggressive music, such as rock and rap? _____

Answer the following questions by checking the appropriate box associated with your response.

6. What is your favorite genre of music?

- Hip Hop & RnB
- Jazz
- Country
- Rap
- Rock
- Classical
- Soul
- Alternative
- Other
 - If other, please write your choice here: _____

7. Mark the activities when you listen to music. (Mark all that apply)

- Working out/Running
- Driving
- Studying
- Homework
- During the school day
- Getting ready in the morning
- Other
 - If other, please write your activity here: _____

Please rank these music genres by placing a number 1 through 5, 1 being your favorite and 5 your least favorite.

8.

| | |
|-------------|-------|
| Rap | _____ |
| Classical | _____ |
| Rock | _____ |
| Country | _____ |
| Alternative | _____ |

Answer the following questions by writing your response on the lines provided.

9. Do you believe you would do better on a quiz with music playing or a quiz without music playing? Why do you believe this?

10. Do you think listening to music could help you complete math problems with a better accuracy, or in other words, get higher test scores? Why do you think this?

Appendix B

Name: _____

Algebra 2

Date: _____ Per: _____

Unit 6: Radical Functions

Quiz 6-1: Radicals & Rational Exponents**Part I: Radicals** – Write final answers in simplest radical form.

1. $\sqrt[3]{256a^{15}b^2}$

2. $8\sqrt[4]{32} - \sqrt[4]{162}$

3. $\sqrt[3]{-3x^2} \cdot \sqrt[3]{24x^5}$

4. $\sqrt{2}(\sqrt{5} - 6\sqrt{12}) + \sqrt{40}$

5. $(4\sqrt{7} + 3)(6\sqrt{7} - 1)$

6. $(\sqrt{3} + \sqrt{2})^2$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Appendix C

Name: _____

Algebra 2

Date: _____ Per: _____

Unit 6: Radical Functions

Quiz 6-1: Radicals & Rational Exponents**Part I: Radicals** – Write final answers in simplest radical form.

1. $\sqrt[3]{250g^2h}$

2. $\sqrt[3]{243} + \sqrt[4]{48}$

3. $\sqrt[3]{-5x^4} \cdot \sqrt[3]{54x^4}$

4. $\sqrt{3}(\sqrt{2} + 3\sqrt{2}) + \sqrt{72}$

5. $(3\sqrt{6} + 2)(4\sqrt{6} - 5)$

6. $(\sqrt{5} + \sqrt{3})^2$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Appendix D

Post-Quiz Survey

This survey is to be completed once you have taken both versions of the quiz, one while no music plays and one while classical music plays. Results will be used for my capstone project at BGSU. Thank you for your time!

*** Required**

1. What is your name? *

2. On which quiz did you do better? *

Mark only one oval.

- ☐ While no music played
- ☐ While classical music played

3. Did you expect to do better on the quiz without music or the one with music? Please explain why you expected either option. *

4. Did your expectations match the results? Why do you think this happened? *

5. Do you plan to now listen to music whenever you study or do homework? *

Mark only one oval.

- ☐ Yes
- ☐ No

6. Would you like to have music playing for future quizzes? *

Mark only one oval.

- ☐ Yes
- ☐ No

7. If you answered yes for the above question, what type of music would you want played while you take a quiz? (Check all that apply) *

- ☐ Rap
- ☐ Country
- ☐ Alternative
- ☐ Classical
- ☐ Instrumentals (no words)
- ☐ Hip Hop
- ☐ Jazz
- ☐ Soul
- ☐ Rock
- ☐ I answered no